B

EXHIBIT B

Description of Network

BILL GATES

BUSINESS

@

THE SPEED OF

THOUGHT

USING A DIGITAL NERVOUS SYSTEM

BILL
GATES

BUSINESS
@
THE
SPEED OF
THOUGHT

USING A
DIGITAL
NERVOUS
SYSTEM

WARNER
BOOKS

22

CREATE CONNECTED LEARNING COMMUNITIES

Our national commitment to connect every classroom in every school in the country to the Internet will be the greatest advance in quality and equality of education in this century.

—Reed Hundt, Chairman of the U.S. Federal Communications Commission

PCs can empower teachers and students more than any other group of knowledge workers. As I mentioned in describing the Web lifestyle, students are the ultimate "knowledge workers" since learning is all about acquiring knowledge. Teachers will be able to use the Internet to share with each other and to allow students to explore a subject in new ways. PCs can be a catalyst for reaching the educational goals that parents, educators, and government have set forth, such as collaborative learning, critical thinking, and lifelong learning skills. With a solid infrastructure in place, some schools are already benefiting from incorporating PCs in the classroom. Even as most schools struggle to find the resources for these new tools,

innovative programs have shown that there is a payoff for the effort.

The success of PCs as educational tools requires teacher involvement. Without teacher training and integration into the curriculum, PCs will not have a big impact. Many PCs have gone into computer "labs" where they sit, seldom used. Schools need to shift from treating the PC as a subject unto itself—teaching about technology—to integrating the PC throughout the curriculum, teaching with technology. More and more school districts are now demonstrating that with the involvement of teachers, PCs used as learning tools can have a profound effect.

In the Western Heights Independent School District, just west of Oklahoma City, Oklahoma, teachers surprised administrators with their enthusiasm when the district provided training the summer before it rolled out PCs. More than 200 of its 230 teachers signed up, causing the district to scramble to schedule enough sessions to handle the demand. Most teachers have a great love of learning, and they'll get excited about anything that will help kids learn. What teachers don't want is to be thrown into something they have not had the opportunity to learn about and become comfortable with.

Western Heights is a small, seven-school district with a moderate industrial tax base. The student population is a multicultural mix of white, black, Native American, Hispanic, and Asian descent. About 65 percent of the kids qualify for free or reduced-cost lunches in the school lunch program. This is not the school district that you might expect to lead the charge into the Information Age. Yet in the last three years the district has overwhelmingly voted three times to spend a total of more than $6.8 million in local funds to create perhaps the leading technology-driven curriculum in the country. The community sees the invest-

ment as the only way to break the cycle of poverty that could repeat with its children if they go unprepared into the digital world.

A PC can be a powerful new teaching tool for teachers coming from the world of blackboards and chalk. Using PowerPoint, for instance, teachers find they can spark kids' interest in the subject by including photos, film clips, and links to Internet pages. One civics teacher at Western Heights starts his class each day with fresh news from the Internet. First is a science photo of the day from a NASA Web page; then news clips from abcnews.com; then a story that leads into his curriculum topic, which could be campaign-finance reform or government checks and balances.

PCs are part of each teacher's life in class at Western Heights, not something outside. Teachers use e-mail to communicate with one another about common issues. They don't have to wait for the district meetings that occur a couple of times a year. They can reach out to a colleague with a question and get an answer back quickly. This collaboration occurs among teachers in each grade level or among teachers coordinating curricula across grade levels, in disciplines such as science, math, and language. Computers are allowing teachers to more easily reach out beyond the confines of their classrooms and interact with their peers.

"People may not realize how alone teachers are in the classroom," Western Heights superintendent Joe Kitchens says. "Most teachers remain behind closed doors all day. They have little time for sharing experiences or interacting with other teachers. There are only a few times a year when they can gather with their peers. E-mail eliminates that isolation." Kitchens laughingly complains that teachers are able to "bug him" more than before, too. Traditionally the superintendent would have limited dialogue with teach-

ers. Now they expect him to answer their questions immediately over e-mail.

Western Heights' PC-based network runs on seventeen miles of fiber-optic cable among the schools and administration building. Each of the 230 classrooms has at least two PCs on the network—one for the teacher, the other for kids to use. Each room is wired for another three PCs to be on the network, and each school has a computer lab. A huge monitor in each classroom enables teachers to display material off the Internet, or films from a central video server, or presentations from another classroom.

University of Oklahoma instructors have taught classes remotely. The meteorologist from the local TV station has taught classes about tornadoes and other weather topics, and students have broadcast weather reports back for public broadcast. Dayton Tire, the area's major employer, has participated in videoconference sessions on topics such as job-interviewing skills and chemical engineering. The TV station and the local tire plant were included in the district's fiber-optic system for just this kind of community involvement in teaching. The university connects through Oklahoma's high-speed education network.

Students have used the videoconferencing system to take virtual field trips to the East Coast, to England, and to other places in Europe, visiting museums and studying with sister schools. Students throughout the district watched the space shuttle launch with John Glenn in late 1998 live over their PCs. Several classrooms are set up specifically for distance learning via PC-based TV. These setups have enabled Western Heights to add advanced math classes in its middle school by TV instruction from the high school. It's not a perfect solution, but it's better than no advanced math class. Teachers have benefited from a videoconference course through the University of Kansas

to help them enhance class content and curriculum with new technologies.

Distance learning has also enabled students at home with injury or illness to keep up with their classes. One teenager was home for months with injuries he sustained protecting his mother from a gunman. Previously the school would have sent out a "home teacher" three times a week for an hour a day. The home teacher would pick up homework, hand off more assignments, and answer a few questions. This time around, Western Heights put a PC, camera, and monitor in the student's bedroom and set up a high-speed link to his home.

Not knowing how well the interactive link was going to work, the school began by connecting him with only one class, but his classmates complained loudly when he "wasn't there" at their next class. The school immediately extended the televised sessions to include all his courses. Biology class was probably the most interesting for him, since the other kids were always sure to hold the really gross dissections up close to the camera, play similar pranks, and otherwise make him feel like part of the group. This home-PC link was cheaper than a home teacher, and the student learned far more. He kept up with his work and grades, but more important, he was never lost as a member of the class. In another instance, a teacher helped direct the work of substitute teachers and stay in touch with her students while she was home because of medical treatments.

CONNECTING WITH PARENTS AND THE COMMUNITY

Another school making similar investments in the future is Reading's Highdown School, a publicly funded state school in a town of 140,000 people west of London. Highdown is

in the heart of the U.K.'s Silicon Valley. A large number of the country's high-tech firms are located within twenty miles. Highdown's proposal to create a connected learning community became one of twenty-three trials accepted as part of the country's digital Superhighways Initiative.

Highdown decided to make technology a central part of the educational experience: to connect the entire community with the school, including museums, libraries, and government offices. Educators wanted a sustainable model so that the approach would not fall by the wayside after the initial enthusiasm waned. They wanted to raise educational performance standards and motivate lifelong learning.

Highdown's network connects more than a hundred PCs in the school with interactive CDs and filtered content from the Internet. As Highdown moves from trial to a long-term program, the local council has joined in to help expand the network to all forty-six schools in the borough. Students have individual computer accounts so they can access productivity applications, e-mail, and the Internet from home.

Parental involvement has been instrumental in the success of the program. Thirty parents participated in the initial development and were able to routinely log in from home to check the school's intranet and find out about their children's activities. Another thirty teachers are connected at home. The school is about to extend the opportunity to link from home to all its parents and is adapting learning materials to allow student learning to be supported at home. Highdown's intranet home page has information on the school and on the subject being taught. The Web site shows parents what students are supposed to learn each week and the approach teachers are using. Parents can link to the materials used by the students. The Internet solves the age-old problem of parents asking their children

whether they have any homework and being unable to verify the answer when the children invariably say, "No." Parents also have immediate access to teachers via e-mail, in addition to personal meetings several times a year.

Like Western Heights, Highdown is integrating technology into the classroom. Its Web page provides special curriculum features that would otherwise not be possible, such as a virtual art tour that links to important museums around the world. Technology makes it easy for teachers to scale classes to age and ability and individualize learning. An eleven-year-old art student, for instance, can go online to access age-appropriate materials prepared by the teacher to support the concepts presented in class on the theory of color. An online test measures understanding of complementary colors, and the student can link to artwork by Seurat to show how he used the eye's perception of colors to create pleasing visual effects.

An independent review of the Highdown experiment by government researchers listed six major benefits of technology-based instruction. These were improved subject learning; improved "network" literacy, meaning skills in using PCs and the Internet to learn; improved vocational training; better motivation and attitudes toward learning; improved skills in independent learning and research; and better social development.

LIFTING THE SKILLS OF ALL CITIZENS

Using the school infrastructure to support education for the entire community is an important way to take advantage of—and to justify—technology investments. One type of education is basic literacy skills in computers that can be applied at any job. Another type, with great potential for

EXHIBIT C

Standard PBX vs IP-Based Telephony Solution

Western Heights Public Schools
Standard PBX vs IP-Based Telephony Solution

Standard PBX			
Item	Unit Price	Qty	Total
Base Unit	$ 27,500	6	$ 165,000
Handsets	$75	1,250	$93,750
Wiring (per Drop)	$100	1,250	$125,000
		TOTAL	**$ 383,750**

IP-Based System			
Item	Unit Price	Qty	Total
MMCX + MAP5	$ 190,634	1	$ 190,634
Definity Prologic System	$ 33,250	1	$ 33,250
		TOTAL	**$ 223,884**

ESTIMATED SAVINGS (IP vs Std PBX) $ 159,866

Feature Comparison

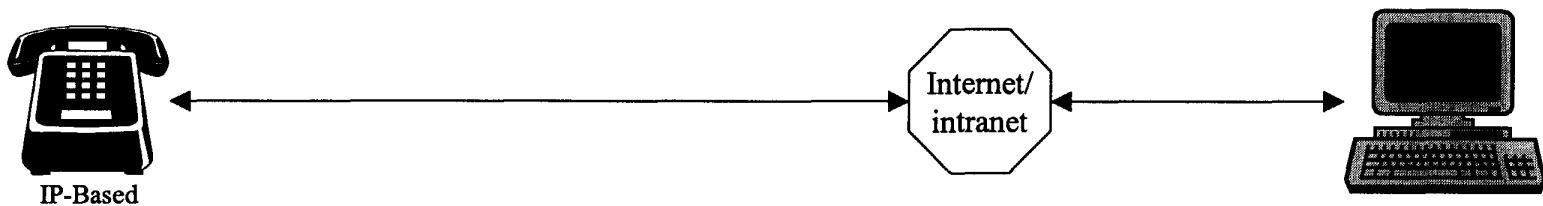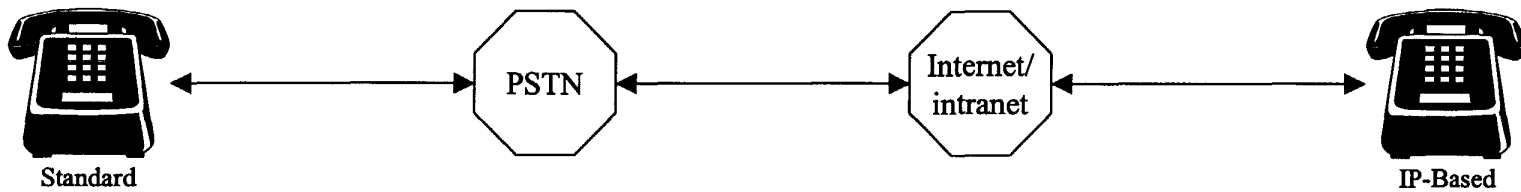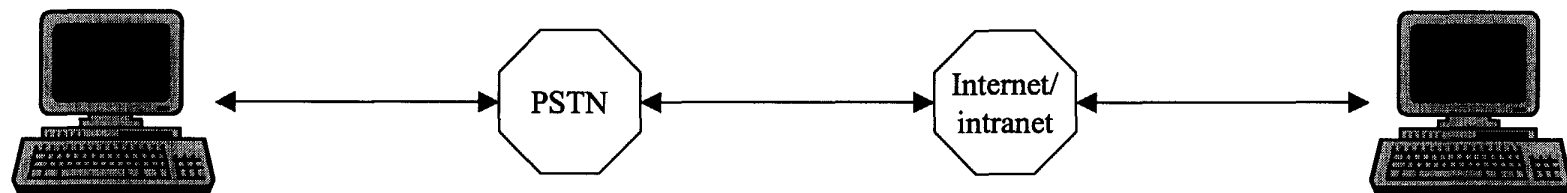| Call Type	PBX	IP-Based
STD Phone-to-STD Phone	☑	☑
STD Phone-to-IP Phone		☑
IP Phone-to-IP Phone		☑
Computer-to-STD Phone		☑
Computer-to-IP Phone		☑
Computer-to-Computer		☑

D

EXHIBIT D

Sample Communications Schemes

Western Heights Public Schools
Sample Communication Schemes

Standard   ↔   PSTN ↔ Internet/intranet ↔

Standard   ↔   PSTN ↔ Internet/intranet ↔

Standard   ↔   PSTN ↔ Internet/intranet ↔ IP-Based

IP-Based   ↔   Internet/intranet ↔

Western Heights Public Schools
Sample Multi-Conference Configuration